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UNITED STATES PATENT APPLICATION

FOR

WIRELESS MODEM

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WIRELESS MODEM

This is a Continuation-In-Part of a copending Application Serial No. 07/966,414, filed October 26, 1992, now patent No. 5,398,101 by G. Dinkins, entitled "Interactive Nationwide Data Service Communication System For Stationary And Mobile Battery Operated Subscriber Units".

TECHNICAL FIELD

This invention relates to an interactive two-way data service network, and more particularly, to communication within an interactive two-way broadcast data service network.

BACKGROUND ART

Communication within an interactive two-way broadcast data service network is described in detail in copending Application Serial No. 07/966,414, filed October 26, 1992, now patent No. 5,398,101 by G. Dinkins, entitled "Interactive Nationwide Data Service Communication System For Stationary And Mobile Battery Operated Subscriber Units" which is incorporated herein by reference. In such a system, a local base station repeater cell comprises a central transmitter and data processing site for transmitting digital data to individual low-cost, portable, battery-

operated, milliwatt transmitter, subscriber units within a local base station designated area. A plurality of receive only stations, remote receivers, are distributed throughout the local base station designated area and are connected by wire, cable, microwave link, or radio to the local base station repeater cell. The remote receivers process and relay transmitted digital data received from the individual subscriber units. Thus, the local base station repeater cell transmits data directly to the individual subscriber units. The milliwatt transmitter individual subscriber units, however, do not transmit data directly back to the local base station repeater cell. Instead, the individual subscriber units transmit to a remote receiver which then relays the data to the local base station repeater cell. The use or remote receivers allows the individual subscriber units to transmit data using power in the milliwatt range.

Unfortunately, under certain conditions, individual subscriber units are unable to receive transmissions from the local base station repeater cell. For example, a user may purchase a subscriber unit and place the subscriber unit in an area which is not yet equipped with or is not covered by a local base station repeater cell. Additionally, a subscriber unit may be located within range of a local base station repeater cell, but may be positioned, for example, in a basement or other physical location which prevents the subscriber unit from receiving transmissions from the local base station repeater cell.

In an attempt to alleviate reception problems, local base station repeater cells have been situated with overlapping coverage to produce strong signals throughout a given area. However, such placement of local base station repeater cells is extremely costly due to the number of local base station repeater cells required, and such "crowded" placement

of the local base station repeater cells is not always practical. In a further attempt to deal with ineffective communication between the local base station repeater cell and the subscriber unit, the location of the user is determined at the time of sale of the subscriber unit to the user. However, even if the user's location is within an area covered by the local base station repeater cell, the subscriber unit might still be placed in a physical location which prevents the subscriber unit from receiving signals from the local base station repeater cell.

Thus, the need has arisen for a system to enable communications between a subscriber unit and a local base station repeater cell in areas where such communication has previously been impaired, which does not require the addition of numerous costly local station repeater cells, which is not dependent on the physical location of the subscriber unit, and which does not significantly increase the cost of communication within the interactive two-way broadcast data service network.

DISCLOSURE OF THE INVENTION

It is therefore an object of the present invention to provide a system to enable communications between a subscriber unit and a local base station repeater cell in areas where such communication has previously been impaired, which does not require the addition of numerous costly local station repeater cells, which is not dependent on the physical location of the subscriber unit, and which does not significantly increase the cost of communication within the interactive two-way broadcast data service network. The above object has been achieved using a modem which is used to enable communications between a subscriber unit and a local base station repeater cell when the

subscriber units are unable to receive rf transmissions from the local base station repeater cell. The local base station repeater cell is connected via a telephone line to the modem. Data communications are sent from the local base station repeater cell to the modem. The modem is also connected via an rf link to the subscriber unit. The modem then transmits the data communications received from the local base station repeater cell to the subscriber unit. Responses from the subscriber unit are then transmitted over the rf link from the subscriber unit to the modem. The modem then transmits the responses over the telephone line to the local base station repeater cell. In so doing, two-way communications in an interactive broadcast network are achieved even in conditions which have previously prevented such communications.

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BRIEF DESCRIPTION OF THE DRAWINGS

The accompanying drawings, which are incorporated in and form a part of this specification, illustrate embodiments of the invention and, together with the description, serve to explain the principles of the invention:

FIGURE 1 shows a Prior Art interactive broadcast system wherein a local base station repeater cell transmits data directly to a subscriber unit.

FIGURE 2 shows a communication system in an interactive broadcast system wherein a modem enables communication between a local base station repeater cell and a subscriber unit over one of two separate paths in accordance with the present invention.

FIGURE 3 shows another embodiment of a communication system in an interactive broadcast system wherein a modem enables communication between a subscriber unit and a network hub switching center in accordance with the present invention.

BEST MODE FOR CARRYING OUT THE INVENTION

Reference will now be made in detail to the preferred embodiments of the invention, examples of which are illustrated in the accompanying drawings. While the invention will be described in conjunction with the preferred embodiments, it will be understood that they are not intended to limit the invention to these embodiments. On the contrary, the invention is intended to cover alternatives, modifications and equivalents, which may be included within the spirit and scope of the invention as defined by the appended claims.

With reference now to Prior Art Figure 1, an interactive broadcast network as set forth in copending Application Serial No. 07/966,414, filed October 26, 1992, now patent No. 5,388,101 by G. Dinkins, entitled "Interactive Nationwide Data Service Communication System For Stationary And Mobile Battery Operated Subscriber Units" is schematically shown. As shown in Prior Art Figure 1, a local base station repeater cell 10 communicates with a subscriber unit 12 over an rf link 14 of, for example 218-219 MHz. Subscriber unit 12 transmits data back to local base station repeater cell 10 via a remote receiver 16. That is, subscriber unit 12 transmits messages directly to remote receiver 16 over an rf link 18. Remote receiver 16 then transfers the messages received from subscriber unit 12 to local base station repeater cell 10 over, for example, hard wire link 20.

With reference still to Prior Art Figure 1, under certain conditions, subscriber unit 12 is unable to receive transmissions via rf link 14 from local base station repeater cell 10. For example, subscriber unit 12 may be placed in an area which is not yet equipped with or is not covered by a local base station repeater cell. Additionally, subscriber

unit 12 may be located within range of local base station repeater cell 10, but may be positioned, for example, in a basement or other physical location which prevents subscriber unit 12 from receiving transmissions from local base station repeater cell 10 over rf link 14.

With reference next to Figure 2, a communication system including a modem 22 for enabling communication between a local base station repeater cell 10 and a subscriber unit 12 is shown. As shown in Figure 2, subscriber unit 12 includes switching means such as, for example, an electronic switch 13 for selecting the path of communication between subscriber unit 12 and local base station repeater cell 10. Specifically, in the present embodiment, if subscriber unit 12 is able to detect rf signals from local base station repeater cell 10 switching means 13 assumes a default position "Path A". When switching means 13 of subscriber unit 12 selects Path A, subscriber unit 12 receives rf signals directly from local base station repeater cell 10 over rf link 14, and transmits data over an rf link 18 to remote receiver 16 which then transfers the data to local base station repeater cell 10 over hard link 20.

With reference again to Figure 2, when subscriber unit 12 is unable to receive rf signals directly from local base station repeater cell 10, switching means 13 selects "Path B". Thus, if subscriber unit 12 is unable to receive rf signals from local base station repeater cell 10, communication between subscriber unit 12 and local base station repeater cell 10 occurs along Path B using modem 22. When switching means 13 of subscriber unit 12 selects Path B, local base station repeater cell 10 transmits messages to modem 22 via, for example, telephone line 24 and public switched network 25. Although a telephone line is used in

the present embodiment, the present invention is also well suited to having local base station repeater cell 10 and modem 22 connected by, for example cable, or other means. As shown in Figure 2, modem 22 communicates with subscriber unit 12 via an rf link 26. In the present embodiment, rf link 26 is at a frequency of approximately 218-219 MHz. Although a frequency of approximately 218-219 MHz is used in the present embodiment, the present invention is also well suited to the use of other frequencies such as, for example, 902 MHz or 45 MHz. Subscriber unit 12 then responds to messages and transmits data messages to local base station repeater cell 10 via modem 22. That is, subscriber unit 12 sends a data message or response over rf link 26 to modem 22. Modem 22 then relays that message or response over link 24 back to local base station repeater cell 10. Thus, two-way communication between local base station repeater cell 10 and subscriber unit 12 is achieved.

With reference still to Figure 2, in the present embodiment, when communicating over Path B, modem 22 is connected to local base station repeater cell 10 through telephone line 24 using, for example, either an 800 or 900 telephone number. Next, TV listings, for example are downloaded into modem 22 and into subscriber unit 12. The telephone link between subscriber unit 22 and local base station repeater cell 10 via modem 22 is broken after approximately 30 seconds allowing for normal use of the telephone line. Use of the link between subscriber unit 22 and local base station repeater cell 10 via modem 22 is protected by a serial number handshake. Initiation of auto dial-up on a daily or more frequent schedule by subscriber unit 12 insures that the data received by subscriber unit 12 remains current.

Referring still to Figure 2, the present invention provides for two-way communication between local base station repeater cell 10 and subscriber unit 12 even if subscriber unit 12 is unable to receive rf signals directly from local base station repeater cell 10. Thus, two-way communication between local base station repeater cell 10 and subscriber unit 12 is achieved even when subscriber unit 12 is placed in an area which is not yet equipped with or is not covered by a local base station repeater cell. Additionally, subscriber unit 12 may be located within range of local base station repeater cell 10, but may be positioned, for example, in a basement or other physical location which prevents subscriber unit 12 from receiving transmissions from local base station repeater cell 10 over rf link 14. Furthermore, because subscriber unit 12 only has to transmit messages to nearby modem 22, subscriber unit 12 has a maximum power output in the milliwatt range.

With reference again to Figure 2, by including remote receiver 16, the present invention is able to function in a standard manner as soon as subscriber unit 12 is able to receive rf signals from local base station repeater cell 10. That is, if subscriber unit 12 is moved, for example, from a basement which prevents the subscriber unit from receiving rf signals from local base station repeater cell 10 to an area in which subscriber unit 12 can receive rf signals from local base station repeater cell 10, conventional two-way communication is resumed. Thus, subscriber unit 12 would receive rf signals directly from local base station repeater cell 10, switching means 13 of subscriber unit 12 would select Path A, and subscriber unit 12 would respond or transmit data messages back to local base station repeater cell 10 via remote receiver 16 thereby eliminating the need for modem 22. Therefore, the present

invention is able to compliment a standard two-way interactive data broadcast network and provide two-way communications even in conditions which have previously prevented such communications. Additionally, the present invention does not substantially increase the cost of the standard two-way interactive data broadcast network, and does not require additional local base station repeater cells.

With reference next to Figure 3, another embodiment of the present invention is shown in which subscriber unit 12 communicates directly with a network hub switching center 30 via modem 22. As shown in the embodiment of Figure 3, in instances where no local base station repeater cell is located proximate to subscriber unit 12, two-way interactive communication is still possible. Because there is no local base station repeater cell, subscriber unit 12 is unable to receive rf signals from a local base station repeater cell. Thus, switching means 13 selects Path B, such that communication to and from subscriber unit 12 occurs through modem 22.

Referring again to Figure 3, in the present embodiment, network hub switching center 30 communicates with modem 22 over hard wire link 32 and public switched network 33. Although a telephone line is used in the present embodiment, the present invention is also well suited to having local network hub switching center 30 and modem 22 connected by, for example cable, or other means. As shown in Figure 3, modem 22 communicates with subscriber unit 12 via an rf link 26. In the present embodiment, rf link 26 is at a frequency of approximately 218-219 MHz. Although a frequency of approximately 218-219 MHz is used in the present embodiment, the present invention is also well suited to the use of other frequencies such as, for example, 902 MHz or 45 MHz.

Subscriber unit 12 then responds to messages and transmits data messages to network hub switching center 30 via modem 22. That is, subscriber unit 12 sends a data message or response over rf link 26 to modem 22. Modem 22 then relays that message or response over link 32 back to network hub switching center 30. Thus, two-way communication between network hub switching center 30 and subscriber unit 12 is achieved.

With reference still to Figure 3, in the present embodiment, modem 22 is connected to network hub switching center 30 through telephone line 32 using, for example, either an 800 or 900 telephone number. The telephone link between subscriber unit 22 and network hub switching center 30 via modem 22 is broken after approximately 30 seconds allowing for normal use of the telephone line. Use of the link between subscriber unit 22 and network hub switching center 30 via modem 22 is protected by a serial number handshake. Initiation of auto dial-up on a daily schedule by subscriber unit 12 insures that the data received by subscriber unit 12 remains current.

With reference again to Figure 3, modem 22 is also adapted to communicate with a local base station repeater cell when a local base station repeater cell is located proximate to subscriber unit 12. That is, modem 22 is also able to transmit data through line 34 to a local base station repeater cell when a local base station repeater cell becomes available. Therefore, the present invention is able to compliment a standard two-way interactive data broadcast network and provide two-way communications even in conditions which have previously prevented such communications. Additionally, the present invention

provides two-way communications even when a local base station repeater cell is not located proximate to a subscriber unit.

The present invention also provides several substantial benefits over a standard two-way interactive data broadcast network. The present invention can be used to provide wireless facsimile service, or to request pay-per-view services even when the subscriber unit is not able to receive rf signals from the local base station repeater cell. Likewise, the present invention also provides for immediate modem access even when the subscriber unit is located, for example, at poolside etc. Additionally, a single modem of the present communication system can be mounted in such a location as to be able to communicate via an rf link to numerous subscriber units placed within homes located, for example, along a single street or within the same neighborhood. In so doing, the present communication system is able to collect data from a number of home appliances, etc.

The foregoing descriptions of specific embodiments of the present invention have been presented for purposes of illustration and description. They are not intended to be exhaustive or to limit the invention to the precise forms disclosed, and obviously many modifications and variations are possible in light of the above teaching. The embodiments were chosen and described in order to best explain the principles of the invention and its practical application, to thereby enable others skilled in the art to best utilize the invention and various embodiments with various modifications as are suited to the particular us contemplated. It is intended that the scope of the invention be defined by the Claims appended hereto and their equivalents.